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Taking Development and Ecology Seriously When Comparing Cognition: Reply to Tomasello and Call (2008)

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Not all chimpanzees are captive chimpanzees and not all humans are White middle-class Westerners. In other words, ecological differences during upbringing and when tested are essential when making interspecies comparisons. C. Boesch (2007) suggested that this is too often forgotten when chimpanzees and humans are compared to understand "what makes us human." The comments by M. Tomasello and J. Call (2008) on C. Boesch (2007) illustrate nicely the urgency to take development and ecology seriously. The author presents additional data illustrating how the physical and social ecological conditions experienced by an individual during upbringing influence the development of his or her cognitive abilities. Such influences during the ontogeny are very diverse and can express themselves rapidly or much later in life. Luckily, some recent research has shown how increasing the fairness of cross-species tests increases the performance of the apes.

Keywords: cross-species comparisons, cognition, development, species differences, within-species variability

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In agreement with my article (Boesch, 2007) and other authors, Tomasello and Call (2008) suggested that the important socioecological differences between captive conditions in the 1950s and today make most former data questionable. If so, why would socioecological differences not be important when comparing abilities under captive versus wild living conditions? Why would ecology not be important for comparisons between chimpanzees and humans living in different ecological and social conditions? The development of long-lived animal species with extended learning abilities will be affected by practice and experience (e.g., Berry, Poortinga, Segall, & Dasen, 2002; Gardner & Gardner, 1989; Mason, 1978). Paralleling primate studies, a recent study of young children living in a socially deprived orphanage showed a very strong positive effect on cognitive development the earlier they were placed in foster care (Nelson et al., 2007). Consistent with a deterministic view of cognitive development (Boesch, 2007), Tomasello and Call were at loss to understand which cognitive abilities might be affected negatively by captive conditions because captive chimpanzees have demonstrated many amazing cognitive skills. Nobody questions the cognitive elaboration of this species; the point is about making fair cross-species comparisons. Revealingly, Tomasello and Call argued that there are *no data* to sustain the claim that wild apes have more sophisticated cognitive skills than captive ones. Thereby, they simply wash away, in one sentence, 50 years of data painstakingly collected by hundreds of researchers in such famous projects as those of Gombe, Mahale, Taï, and Kibale chimpanzees. Not only did these scientists produce masses of data, but many of the data pertain directly to cognitive abilities: cooperative abilities systematically documented in coalitions and alliances and in coordinated groups for hunting and territorial defense; altruistic and empathic abilities, including adoption and help to unrelated individuals; and culture, deception, pointing, mental maps, and others (Boesch, 1992, 2003, 2005; de Waal, 2001; Nishida, & Hosaka, 1996; Sanz, Morgan, & Gulik, 2004). To be sure, these data were not produced with experimental designs similar to those used with captive chimpanzees. But why should one set of data be declared as data and other sets not? Ironically, Tomasello and Call asked for our tolerance when chimpanzees are not tested under the same conditions as humans "because it is not possible" (2008, p. 449). Why should we grant them tolerance for their violation of the experimental paradigm, when they decline any tolerance for field data?

"Of course there are many cognitive skills that differ among the people of different cultures," admitted Tomasello and Call (2008, p. 451). So we agree, but then why not consider them? Why should one accept that only White middle-class Western (WMC) free-ranging humans are the reference to be used for comparisons with captive chimpanzees? Tomasello and Call simply ignored this very important point. Besides the notion of space and theory of mind I reviewed (Boesch, 2007), recent data have detailed how upbringing conditions dramatically affect the way humans count and make mathematical operations (Beller & Bender, 2008; Gordon, 2004; Pica, Lemer, Izard, & Dehaene, 2004; Saxe & Esmonde, 2004; Tang et al., 2006) and how such practices affect the areas of the brain activated (Tang et al., 2006). New studies have revealed how divergent human numerical solutions may be different from those of WMC humans (Beller & Bender, 2008). This documents how

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different practices produce large cognitive differences in humans and how profound this effect is on brain functioning. The WMC solution has nevertheless always been used for cross-species comparisons.

Because there is no a priori reason to believe that apes have adopted conventional WMC cognitive solutions, all experiments using WMC cognitive solutions say rather little about human–chimpanzee differences. The cognitive solutions adopted by forest-living humans, an ecological situation close to forest-dwelling apes, seem much more suitable for cross-species comparisons.

Ecological Differences in Cross-Species Experiments

The ecological differences under which tests are presented to chimpanzees and humans are evident; as a rule, chimpanzees, contrary to humans, are always tested while isolated from all other group members and are kept permanently in cages with significant barriers isolating them from an experimenter of another species. When tested under conditions without such handicaps, they fare significantly better (Boesch, 2007). Tomasello and Call (2008) avoided addressing this central point. New data published since my 2007 article (Boesch, 2007), however, have confirmed this trend; imitation and emulation have been demonstrated for the first time in chimpanzees using a test design in which chimpanzees and humans were tested in the same room as the conspecific demonstrator (Hopper, Lambeth, Schapiro, & Whiten, 2008), and superior numerical memory has been shown in chimpanzees over humans in a test in which they faced the same test conditions and the infant chimpanzees remained with their mothers (Inoue & Matsuzawa, 2007).

Tomasello and Call (2008) implied that they have controlled for all the differences they enforced when comparing chimpanzees with humans, but this seems far from reality. I am aware of no study, and none from Tomasello's laboratory, that systematically compares the effect of the presence of and physical contact with the parent in humans and chimpanzees on testing performance. It is obvious from the videos accompanying the Tomasello team's work (e.g., in Herrmann, Call, Lloreda, Hare, & Tomasello, 2007, and Warneken & Tomasello, 2006) that a very important Clever Hans effect between the child and his parent is occurring, and the reluctance of Tomasello and Call to control for this effect is worrisome for the fairness of future cross-species comparisons under such conditions (as confirmed by the ignorance of this problem in Herrmann, Call, Lloreda, Hare, & Tomasello, 2008). Furthermore, can Tomasello and Call seriously pretend that a piece of Plexiglas placed on a table in a room in which the child, the parent, and the experimenter can move about freely is equivalent to the permanent bars or walls that separate captive chimpanzees from the researchers?

Finally, one has to accept that it takes time for the developmental effects of different ecological conditions to express themselves. Matsuzawa's research group has invested years in developing a trustful relation with young chimpanzees from birth onward so that testing can now be done in the presence of the mother with the human experimenters in the same room, and when 4-year-old chimpanzee Ayumu was tested for numerical memory he clearly out-competed adult humans (Inoue & Matsuzawa, 2007). I am convinced that more such performances will be demonstrated as Ayumu and the other youngsters brought up under such favorable conditions are tested (remember Rico's performance; Kaminski, Call, & Fischer, 2004). At the same time, this illustrates, contrary to Tomasello and Call's (2008) claim, that testing methods less disadvantageous to chimpanzees are possible and very successful. Here, the majority of the results obtained show that chimpanzees either are equal to or outcompete humans (Boesch, 2007).

To conclude, I would like to stress again that the answer to the question "What makes us humans?" will only be solved through a multidisciplinary approach. Development and ecology may be valued differently in different scientific fields, but it is necessary to make the effort to acknowledge their contribution to cognitive development in different species. The effects of ecological variations on human and chimpanzee cognition need to be systematically explored, and to reach that goal, psychologists and biologists need to unite their efforts. Recently, some psychologists have taken this challenge seriously, and their results are enlightening, showing that under suitable conditions chimpanzees decisively succeed in tasks that they previously failed (Horner, Whiten, Flynne, & de Waal, 2006; Hopper et al., 2008; Inoue & Matsuzawa, 2007; Whiten et al., 2007). These are captive chimpanzees and so not representative of the species, but at least the testing procedure was fairer and therefore the results are more representative of the cognitive capacities of those captive individuals.

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